

PROPORTIONALITY (VARIATION)

(P1) (4 MARKS)



$$\odot \propto \longrightarrow \odot = k$$

1) y is directly proportional to x

$$y \propto x$$

$$y = kx$$

2) y is inversely proportional to x .

$$y \propto \frac{1}{x}$$

$$y = \frac{k}{x}$$

3) y is directly proportional to square of x

$$y \propto x^2$$

$$y = kx^2$$

4) y is inversely proportional to cube of x

$$y \propto \frac{1}{x^3}$$

$$y = \frac{k}{x^3}$$

5) y is inversely proportional to cube root of x

$$y \propto \frac{1}{\sqrt[3]{x}}$$

$$y = \frac{k}{\sqrt[3]{x}}$$

Q. y is inversely proportional to x^2

Given that when $x=2$, $y=9$.

(i) Find the formula relating x and y

(2)

$$y \propto \frac{1}{x^2}$$

$$y = \frac{k}{x^2}$$

$$x=2, y=9$$

$$9 = \frac{k}{2^2}$$

$$k=36$$

$$y = \frac{36}{x^2}$$

(ii) Find y when

$$x=5.$$

(2)

$$y = \frac{36}{x^2} = \frac{36}{5^2} = \frac{36}{25}$$

ADVANCED

(1 MARK) (NO WORKING).

$$y \propto x^1$$

$\times 2 \leftarrow \times 2$
 $\div 5 \leftarrow \div 5$

$$y \propto \frac{1}{x}$$

$\div 2 \leftarrow \times 2$
 $\times 5 \leftarrow \div 5$

$$y \propto x^2$$

$\times 4 \leftarrow \times 2$

$$y \propto \frac{1}{x^3}$$

$$\div 9 \leftarrow \div 3$$

$$\div 8 \leftarrow \times 2$$

$$\times 125 \leftarrow \div 5$$

Q: y is directly proportional to cube of x .

$$y \propto x^3$$
$$\times 27 \leftarrow \times 3$$

What happens to value of y if x is tripled.

When x is tripled, y is multiplied by 27

Q: y is directly proportional to x^2 .

For a certain value of x , $y = 10$.

Find the value of y when this value

of x is doubled. (1 mark).

$$y \propto x^2$$

$$\times 4 \leftarrow \times 2$$

$$\begin{array}{ccc} \text{old } x & \longrightarrow & \text{old } y = 10 \\ \downarrow \times 2 & & \downarrow \times 4 \end{array}$$

$$\text{new } x \longrightarrow \text{new } y = 40$$

- (c) M is directly proportional to L^3 .

How many times larger is M when L is multiplied by 2?

$$M \propto L^3$$

$\times 8 \leftarrow \times 2$

Answer 8 times [1]

- (b) p is inversely proportional to q .

It is known that $p = 15$ for a particular value of q .

Write down the value of p when this value of q is doubled

Answer $p =$ 7.5 [1]

$$p \propto \frac{1}{q}$$

$\div 2 \leftarrow \times 1$

old q	$\longrightarrow$	old $p = 15$
$\downarrow \times 2$		$\downarrow \div 2$
new q	$\longrightarrow$	new $p = 7.5$

Physics

$$R \propto L$$

$$x2 \leftarrow x2$$

$$\div 5 \leftarrow \div 5$$

$$R \propto \frac{1}{A}$$

$$A$$

$$x2 \leftarrow \div 2$$

$$R \propto \frac{1}{\pi r^2}$$

$$\pi r^2$$

$$\div 4 \leftarrow x2$$

29 y varies inversely as the square of x .

(a) When $x = 2$, $y = 9$.

Find the value of y when $x = 3$.

$$y \propto \frac{1}{x^2} \quad | \quad 9 = \frac{k}{2^2}$$

$$y = \frac{k}{x^2} \quad | \quad k = 9 \times 4 = 36$$

$$y = \frac{36}{x^2} = \frac{36}{3^2} = \frac{36}{9} = 4$$

Answer $y = 4$ [2]

(b) When $x = n$, $y = p$.

double

Write down an expression for y , in terms of p , when $x = 2n$.

$$y \propto \frac{1}{x^2}$$

$$\div 4 \leftarrow x2$$

$$\text{old } y = p$$

$$\div 4$$

$$\text{new } y = \frac{p}{4}$$

Answer $\frac{p}{4}$ [1]

- 12** y is inversely proportional to x .
The table shows some values of x and y .

x	3	4	q	n
y	20	p	5	m

- (a) Find p .

Answer $p = \dots\dots\dots$ [1]

- (b) Find q .

Answer $q = \dots\dots\dots$ [1]

- (c) Express m in terms of n .

Answer $m = \dots\dots\dots$ [1]
